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Indian Standard

SPECIFICATION FOR VELOCITY RODS

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SPECIFICATION FOR VELOCITY RODS

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Indian Standard

SPECIFICATION FOR VELOCITY RODS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 23 July 1968, after the draft finalized by the Fluid Flow Measurement Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 While current meters should be used as far as possible for the measurement of velocity of flow in open channels, under certain circumstances it may not be possible or advisable to use a current meter and in such circumstances surface floats and velocity rods may have to be used. While the surface floats give only surface velocity and the mean velocity has to be deduced with some consequential inaccuracy, velocity rods directly give the mean velocity to a fair degree of accuracy. However, the use of velocity rods is restricted to sites where the bed of the stream is uniform and free of large humps, that is for measurement of velocities in regular canals.

0.3 In the formulation of this standard due weightage has been given to the practices in the field in this country.

0.4 Assistance has also been derived from the Ganga Discharge Circle, Ministry of Irrigation & Power.

0.5 This standard is one of a series of Indian Standards on the instruments used in the measurement of flow in streams and sediment. Other standards published so far in the series are:

IS : 3910-1966 Specification for current meter (cup type) for water flow measurement

IS : 3911-1966 Specification for surface floats

IS : 3912-1966 Specification for sounding rods

IS : 3913-1966 Specification for suspended sediment load samplers

IS : 3917-1966 Specification for bed material samplers (scoop type)

IS : 3918-1966 Code of practice for use of current meter (cup type) for water flow measurements

IS : 4073-1967 Specification for fish weights

IS : 4080-1967 Specification for vertical staff gauges

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS:2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard,

1. SCOPE

1.1 This standard specifies the functional requirements, test to be carried out, and materials to be used, for both single tube rigid velocity rods and telescopic (adjustable) velocity rods. Typical examples are provided in Appendix A.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS:1191-1959† shall apply.

3. FUNCTIONAL REQUIREMENTS

3.1 Velocity rods should satisfy the requirements in **3.1.1** to **3.1.4**.

3.1.1 The mean velocity on a vertical as obtained by a current meter by the integration method and the mean velocity obtained by the velocity rod for the panel enclosing the same vertical, shall be practically the same without any significant error (*see* **5.1.1**).

3.1.2 The rod should not touch the channel bottom and weeds or acquatic growth on the channel bed should not obstruct the free run of the rod.

3.1.3 The rod should be sufficiently weighted so that the rod remains truly vertical.

3.1.4 The rod should have at least 5 cm projection above the water surface.

3.2 The rod gives best results when immersed up to 0·95 of the depth of the channel.

3.2.1 If by some reason or other, rods of lesser depth are to be used, the correction factors for various depths (up to 0·9 d) are calculated by the following formula:

$$V_{\text{mean}} = V_{\text{rod}} \left(1{\cdot}012 - 0{\cdot}116 \sqrt{\frac{d-l}{d}} \right)$$

*Rules for rounding off numerical values (*revised*).

†Glossary of terms and symbols used in connection with the measurement of liquid flow with a free surface. (**Since revised**).

where

d = depth of water, and

l = submerged portion of the rod.

The correction factors calculated by the above formula for various depths (in any event not less than 0·65 depth) are given below:

l (*Submerged Depth*)	*Correction Factor*
0·65 *d*	0·943 4
0·70 *d*	0·948 5
0·75 *d*	0·954 0
0·80 *d*	0·960 0
0·85 *d*	0·967 1
0·90 *d*	0·975 3

4. MATERIALS

4.1 The material for the rod should be light and should not be affected by water and shall conform to the following requirements:

a) *Wood* — completely seasoned, of light weight, specific gravity less than 0·5, for example chaplash, kail, etc.

b) *Galvanized steel sheet* — conforming to the relevant Indian Standards.

4.2 Paintings should be of fast colour, distinctly visible and waterproof. It is preferable to have them conspicuously painted in parts, black, white and red.

5. METHODS OF TEST

5.1 The following test shall be made on 3 of the velocity rods from a batch of 24 (of the same size, shape, material, etc) for acceptance of rods.

5.1.1 They should be tested in a standard canal at a regular cross-section. The difference between the mean velocity as obtained by the rod, and the mean velocity on the central vertical in the same panel as obtained with a cup type current meter by integration method shall not be more than ± 2 percent when wind interference is negligible.

5.1.1.1 The average result of the 3 rods may be considered for the compliance of this test.

6. MARKING

6.1 These rods shall be marked with their actual dimensions, weight and tolerance values in velocity measurements as compared to a standard cup type current meter (specifying the depth and velocity of flow at which the comparison was made).

6.1.1 These rods may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

APPENDIX A
(*Clause* 1.1)

TYPICAL EXAMPLES OF VELOCITY RODS

A-1. GENERAL

A-1.1 As these rods are weighted at the bottom and generally submerged up to 0·95 of the depth of water, which is a variable quantity, it is difficult to recommend a fix length for these rods. Alternatively these rods may be provided with thread on one end and collar on the other end, with provision for adding suitable weights to keep the rods vertical. Velocity rods are broadly classified into 2 types as detailed below:

a) Velocity rod, rigid (single tube); and

b) Telescopic (adjustable) velocity rod.

A-2. RIGID VELOCITY ROD (SINGLE TUBE)

A-2.0 General Description — This type of rod is used when the depths are uniform and do not vary from vertical to vertical. As these rods are of fixed lengths, large number of rods of various lengths will be required if there are variations in depth from vertical to vertical. This may be made of wood or galvanized steel sheet.

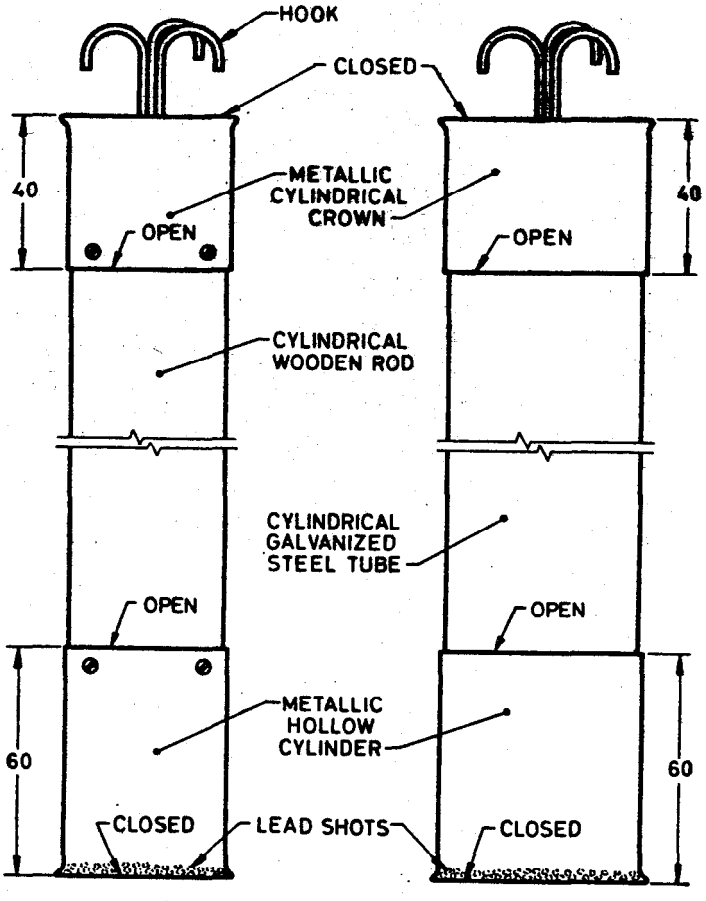
A-2.1 Details of Wooden Velocity Rod

A-2.1.1 It consists of a cylindrical wooden rod at the centre, a metallic hollow cylinder at the bottom and a metallic crown with hooks at the top as shown in Fig. 1A.

A-2.1.2 *Central Cylindrical Wooden Rod* — It shall be made of completely seasoned light-weight wood of round shape with diameters ranging from 35 to 50 mm and lengths ranging up to 3 m.

A-2.1.3 *Metallic Hollow Cylinder at the Bottom* — It should be made of galvanized steel sheet approximately 0·80 mm thick in the form of hollow cylinder with its top open and bottom closed. It shall be weighted at the bottom by the addition of lead shots so that the rod remains truly vertical during its submergence. This bottom galvanized steel cylinder should be fitted to the central wooden rod by means of screws fixed from outside and made leak-proof as far as possible.

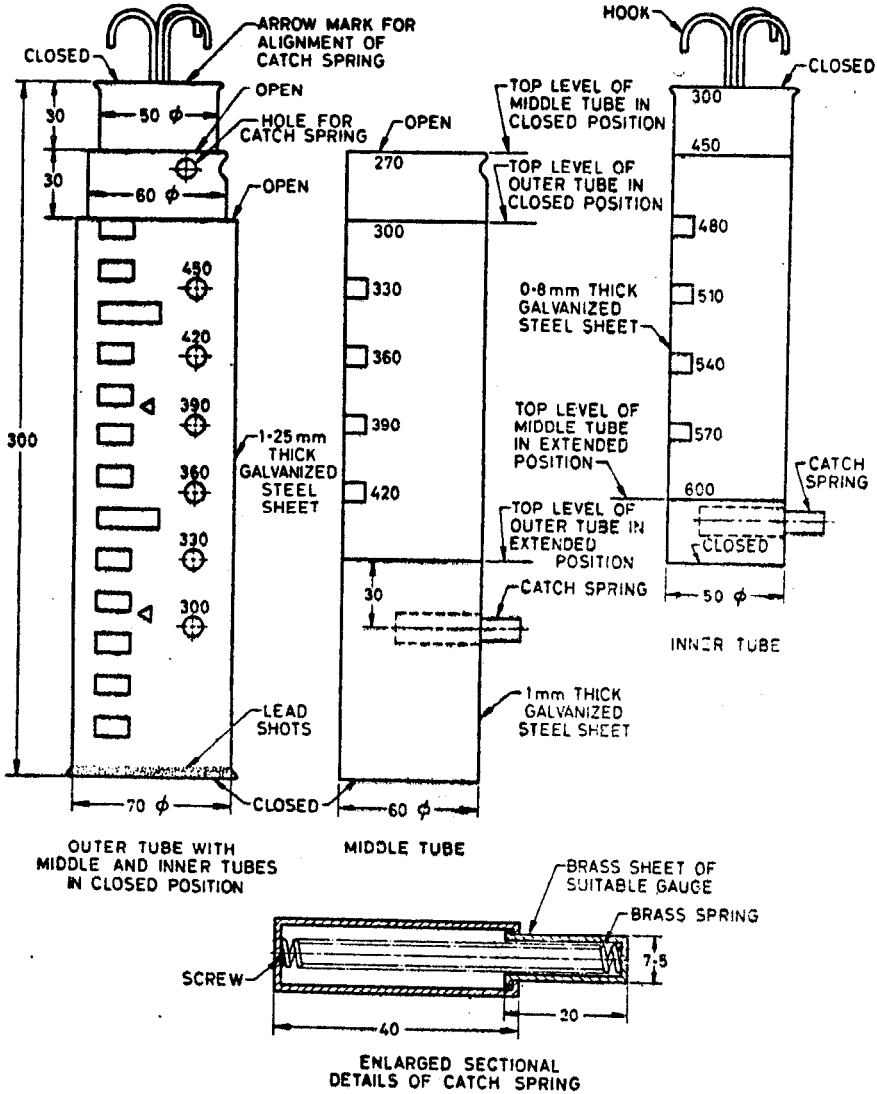
A-2.1.4 *Metallic Crown with Hooks* — It shall be made of galvanized steel sheet approximately 0·80 mm thick in the form of a hollow cylinder with top closed and bottom open. The open bottom end of the cylinder should be fitted to the top of the central wooden rod from the outside by means of screws. An assembly of umbrella handle shaped hooks three in number should be welded to the top of the cylinder as shown in Fig. 1A. These hooks should be made of steel rod of about 2 mm.



1A Velocity Rod (Wooden) 1B Velocity Rod (Galvanized Steel Sheet)

All dimensions are in millimetres and approximate.

FIG. 1 VELOCITY RODS (*Continued*)



IC Telescopic Velocity Rod (Adjustable)

All dimensions are in millimetres and approximate.

FIG. 1 VELOCITY RODS

A-2.1.5 *Painting* — The bottom and top metallic cylinder with hook assembly shall be painted with black enamel paint and the cylindrical wooden rod in black paint, so that the rod becomes conspicuous.

A-2.1.6 *Sizes* — These rods may be of various sizes with diameters varying from 35 to 50 mm and the lengths varying from 300 mm to 3·0 m which can be used according to the depth at the measuring sites, with the weight suitably adjusted.

A-2.2 Galvanized Steel Sheet Velocity Rod

A-2.2.1 It consists of a cylindrical galvanized steel pipe tube at the centre, a metallic crown with hooks at the top and a metallic hollow cylinder at the bottom as shown in Fig. 1B.

A-2.2.2 *Central Cylindrical Tube* — It should be made from 1 mm ± 0·2 mm thick galvanized steel sheet into round shape with diameters ranging from 35 to 70 mm and lengths ranging up to 4·5 m. The joint shall be welded properly so that it is neat and leak-proof.

A-2.2.3 *Metallic Crown with Hooks* — A hollow metallic cylinder of the same gauge as cylindrical tube with its bottom open and top closed shall be welded to the top of cylindrical tube. To the top of the cylinder an assembly of umbrella handle shaped hooks three in number should be welded as shown in Fig. 1B. These hooks should be made of about 2 mm dia steel rod.

A-2.2.4 *Metallic Hollow Cylinder at the Bottom* — A hollow metallic cylinder of the same gauge as the cylindrical tube with its bottom closed and top open should be welded to the cylinder so that its base is strong enough to withstand any knocking due to outcrops on the bed of the channel. Lead shots should be added to its bottom to make the velocity rod float in a vertical position.

A-2.2.5 *Painting* — The whole assembly of the velocity rod shall be painted with black enamel paint, with distinguishing black and white paint on the crown.

A-3. TELESCOPIC VELOCITY ROD (ADJUSTABLE)

A-3.0 General — This type of rod is useful when rods of different lengths are required as their lengths are adjustable. The life of these rods is less than the rigid rods, because of constant alterations in length, holes get bigger and lead to drowning of the rods. These rods are generally manufactured to read from 300 to 600 mm, 450 to 750 mm, 600 to 1 200 mm, 1 to 2 m, 2 to 3 m, and 3 to 5 m.

A-3.1 Details of Telescopic Velocity Rods (Adjustable)

A-3.1.1 It consists of 3 metallic hollow tubes one working inside the other and each closed at the bottom as shown in Fig. 1C. The exterior cylindrical tube is weighted by the addition of lead shots.

A-3.1.2 *Outer Tube* — The outermost tube should be approximately 70 mm diameter and made of approximately 1·25 mm thick galvanized steel sheet. Its bottom and its sides should be welded properly so that they are leak-proof. In this tube, holes should be made so that the rods can be adjusted to read a difference of 30 mm in the length of the rod, as shown in Fig. 1C. If the rod is made to read from 300 to 450 mm the length range for making holes will be 150 mm and if the range is 300 mm, these holes will be spaced in a length of 300 mm and so on. The graduations on the outer tube should be marked according to the length of the total rod. Thus, if the length of the total rod from top end of innermost tube to base of the outermost tube is 300 mm, the lowest holes should be marked 300 mm and if it is one metre, the lowest hole should be marked as 1 metre and so on. All these holes shall be closed by tight fitting rivets to make these leak-proof. Its sides and base shall be properly welded.

A-3.1.3 *Middle Tube* — The middle tube should be approximately 60 mm in diameter and made of approximately 1·0 mm thick galvanized steel sheet and should be closed at the bottom. It should be longer in length than the outer tube by half the distance of the lowest hole in the outer tube. When this tube is pulled outside the outer tube, the spring catch is manoeuvred to fit in the desired hole by hand and the rest of the holes are closed by rivets as explained above, thus making the outer tube leak-proof.

A-3.1.4 *Inner Tube* — The inner most tube should be approximately 50 mm in diameter and of 0·80 mm thick galvanized steel sheet with its bottom and top closed by proper welding. Its sides should be properly welded to make it leak proof. Its length protruding outside the middle tube should be the same as the middle tube is protruding outside the outer tube, so that when both the middle and inner tubes are resting at their base the rod should read the minimum length it is intended to, without any adjustment. The inner tube should have a spring catch, which should prevent its sliding down the middle tube as shown in Fig. 1C. Suitable size and type of rubber packing shall be provided between the inside of the tubes so as to make them watertight. The outer tube, middle tube and inner tube should be properly marked as shown in Fig. 1C.

A-3.1.4.1 An assembly of umbrella handle shaped hooks three in number should be attached to the top of the inner most cylindrical tube as shown in Fig. 1C. These hooks should consist of approximately 2 mm dia, steel rod.

NOTE — For lengths more than 450 mm and up to 600 mm the inner most tube should be pulled out first to its entire length to read 450 mm without pulling out the middle tube. Then the increase in lengths of 30 mm up to 600 mm may be managed by pulling middle tube.

A-3.1.5 *Painting* — The whole assembly shall be painted with distinguishing black and white paint.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Conversion*
Force	newton	N	1 N = 1 kg.1 m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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